

WHAT IS CLAIMED IS:

1. A heat-transfer label assembly, said heat-transfer label assembly comprising:

(a) a carrier;

(b) a wax skim coat deposited onto said carrier; and

(c) a heat-transfer label, said heat-transfer label being deposited onto said wax skim coat for transfer of said heat-transfer label from said carrier to an article under conditions of heat and pressure, said heat-transfer label comprising one or more ink design layers, each of said ink design layers being thermosetting within about 1-2 minutes after said ink design layer has been transferred to an article heated to a temperature of about 250°F-325°F.

2. The heat-transfer label assembly as claimed in claim 1 wherein said heat-transfer label consists of said one or more ink design layers.

3. The heat-transfer label assembly as claimed in claim 1 wherein each of said ink design layers comprises a binder, a colorant and a cross-linking system, said cross-linking system being adapted to effect cross-linking of the binder within about 1-2 minutes after said ink design layer has been transferred to an article heated to a temperature of about 250°F-325°F.

4. The heat-transfer label assembly as claimed in claim 3 wherein said binder comprises one or more resins selected from the group consisting of polyester resins, polyester/vinyl resins, polyamide resins, phenoxy resins, epoxy resins, polyketone resins, and acrylic resins.

5. The heat-transfer label assembly as claimed in claim 4 wherein said binder additionally comprises a vinyl chloride/vinyl acetate resin.

6. The heat-transfer label assembly as claimed in claim 5 wherein said vinyl chloride/vinyl acetate resin constitutes up to about 25%, by weight, of said binder.

7. The heat-transfer label as claimed in claim 4 wherein said binder comprises a copolyester resin having a high tensile strength and low elongation.

8. The heat-transfer label as claimed in claim 3 wherein said colorant is a pigment, said pigment being present in an amount ranging from about 50% to about 200%, by weight, of the total of said binder and said cross-linking system.

9. The heat-transfer label as claimed in claim 8 wherein said pigment is titanium dioxide.

10. The heat-transfer label as claimed in claim 3 wherein said cross-linking system comprises (i) a cross-linking resin for cross-linking said binder and (ii) a heat-activatable catalyst for catalyzing the cross-linking of said cross-linking resin to the binder within about 1-2 minutes after transfer of said heat-transfer label to an article heated to a temperature in the range of about 250°F-325°F.

11. The heat-transfer label as claimed in claim 10 wherein said cross-linking resin is present in an amount constituting about 5%-10%, by weight, of said binder.

12. The heat-transfer label as claimed in claim 10 wherein said cross-linking resin comprises a melamine-formaldehyde resin.

13. The heat-transfer label as claimed in claim 12 wherein said cross-linking resin comprises a partially methylated melamine-formaldehyde resin.

14. The heat-transfer label as claimed in claim 12 wherein said heat-activatable catalyst is an amine-blocked sulfonic acid catalyst.

15. The heat-transfer label assembly as claimed in claim 1 wherein said carrier comprises a paper substrate overcoated with a layer of polyethylene, said wax skim coat being deposited onto said polyethylene layer.

16. A heat-transfer label assembly, said heat-transfer label assembly comprising:

(a) a carrier; and

(b) a heat-transfer label, said heat-transfer label being deposited onto said carrier for transfer of said heat-transfer label from said carrier to an article under conditions of heat and pressure, said heat-transfer label comprising one or more ink design layers, each of said ink design layers being thermosetting within about 1-2 minutes after said ink design layer has been transferred to an article heated to a temperature of about 250°F-325°F;

(c) wherein said carrier is made of a non-wax material that separates cleanly from said heat-transfer label with no visually discernible portion of said carrier being transferred to the article along with said heat-transfer label.

17. The heat-transfer label assembly as claimed in claim 16 wherein said carrier comprises a polymeric film overcoated with a release coating made of a non-wax, non-silicone, thermoset release material, said release coating having a total surface energy of about 25 to 35 mN/m, of which about 0.1 to 4 mN/m is polar surface energy, and having a carbon content (by atomic %) of about 97% and an oxygen content (by atomic %) of about 3%, as measured by X-ray photoelectron spectroscopy.

18. The heat-transfer label assembly as claimed in claim 17 wherein said polymeric film is made of a polymer selected from the group consisting of polyesters, polyolefins and polyamides and wherein said release coating is made by (i) applying to the polymeric film in its amorphous or semi-oriented state a composition comprising (a) a functionalized α -olefin containing copolymer and (b) a crosslinking agent; and (ii) reacting said composition with the carrier during uniaxial or biaxial stretching and heat setting.

19. The heat-transfer label assembly as claimed in claim 16 wherein said heat-transfer label consists of said one or more ink design layers.

20. The heat-transfer label assembly as claimed in claim 16 wherein each of said ink design layers comprises a binder, a colorant and a cross-linking system, said cross-linking system being adapted to effect cross-linking of the binder within about 1-2 minutes after said ink design layer has been transferred to an article heated to a temperature of about 250°F-325°F.

21. The heat-transfer label assembly as claimed in claim 20 wherein said binder comprises one or more resins selected from the group consisting of polyester resins, polyester/vinyl resins, polyamide resins, phenoxy resins, epoxy resins, polyketone resins, and acrylic resins.

22. The heat-transfer label assembly as claimed in claim 21 wherein said binder additionally comprises a vinyl chloride/vinyl acetate resin.

23. The heat-transfer label assembly as claimed in claim 22 wherein said vinyl chloride/vinyl acetate resin constitutes up to about 25%, by weight, of said binder.

24. The heat-transfer label as claimed in claim 21 wherein said binder comprises a copolyester resin having a high tensile strength and low elongation.

25. The heat-transfer label as claimed in claim 20 wherein said colorant is a pigment, said pigment being present in an amount ranging from about 50% to 200%, by weight, of the total of said binder and said cross-linking system.

26. The heat-transfer label as claimed in claim 25 wherein said pigment is titanium dioxide.

27. The heat-transfer label as claimed in claim 20 wherein said cross-linking system comprises (i) a cross-linking resin for cross-linking said binder and (ii) a heat-activatable catalyst for catalyzing the cross-linking of said cross-linking resin to the binder within about 1-2 minutes

after transfer of said heat-transfer label to an article heated to a temperature in the range of about 250°F-325°F.

28. The heat-transfer label as claimed in claim 27 wherein said cross-linking resin is present in an amount constituting about 5%-10%, by weight, of said binder.

29. The heat-transfer label as claimed in claim 27 wherein said cross-linking resin comprises a melamine-formaldehyde resin.

30. The heat-transfer label as claimed in claim 29 wherein said cross-linking resin comprises a partially methylated melamine-formaldehyde resin.

31. The heat-transfer label as claimed in claim 29 wherein said heat-activatable catalyst is an amine-blocked sulfonic acid catalyst.

32. An ink formulation comprising:

(a) a binder resin;

(b) a colorant;

(c) one or more volatile solvents; and

(d) a cross-linking system, said cross-linking system being adapted to effect cross-linking of the binder resin within about 1-2 minutes after application of a dried, printed design made with said ink formulation to an article heated to a temperature of about 250°F-325°F.

33. The ink formulation as claimed in claim 32 wherein said binder resin comprises one or more resins selected from the group consisting of polyester resins, polyester/vinyl resins, polyamide resins, phenoxy resins, epoxy resins, polyketone resins, and acrylic resins.

34. The ink formulation as claimed in claim 33 wherein said binder resin additionally comprises a vinyl chloride/vinyl acetate resin.

35. The ink formulation as claimed in claim 34 wherein said vinyl chloride/vinyl acetate resin constitutes up to about 25%, by weight, of said binder resin.

36. The ink formulation as claimed in claim 33 wherein said binder comprises a copolyester resin having a high tensile strength and low elongation.

37. The ink formulation as claimed in claim 32 wherein said colorant is a pigment, said pigment being present in an amount ranging about 50% to 200%, by weight, of the total of said binder resin and said cross-linking system.

38. The ink formulation as claimed in claim 37 wherein said pigment is titanium dioxide.

39. The ink formulation as claimed in claim 32 wherein said cross-linking system comprises (i) a cross-linking resin for cross-linking said binder and (ii) a heat-activatable catalyst for catalyzing the cross-linking of said cross-linking resin to the binder resin within about 1-2 minutes after application of a dried, printed design made with said ink formulation to an article heated to a temperature in the range of about 250°F-325°F.

40. The ink formulation as claimed in claim 39 wherein said cross-linking resin is present in an amount constituting about 5%-10%, by weight, of said binder resin.

41. The ink formulation as claimed in claim 39 wherein said cross-linking resin comprises a melamine-formaldehyde resin.

42. The ink formulation as claimed in claim 41 wherein said cross-linking resin comprises a partially methylated melamine-formaldehyde resin.

43. The ink formulation as claimed in claim 41 wherein said heat-activatable catalyst is an amine-blocked sulfonic acid catalyst.

44. A method of decorating a glass article, said method comprising the steps of:

(a) providing a heat-transfer label assembly, said heat-transfer label assembly comprising:

(i) a carrier; and

(ii) a heat-transfer label, said heat-transfer label being releasably secured to said carrier for transfer of said heat-transfer label from said carrier to a glass article under conditions of heat and pressure, said heat-transfer label comprising one or more ink design layers, each of said ink design layers being thermosetting within about 1-2 minutes after said ink design layer has been transferred to a glass article heated to a temperature of about 250°F-325°F;

(b) providing a glass article;

(c) heating said glass article to a temperature of about 250°F-325°F; and

(d) while said glass article is at said temperature of about 250°F-325°F, transferring said heat-transfer label from said carrier to said glass article.

45. The method as claimed in claim 44 wherein said heat-transfer label consists of said one or more ink design layers.

46. The method as claimed in claim 45 wherein said carrier comprises a paper substrate overcoated with a layer of polyethylene and wherein said heat-transfer label assembly further comprises a wax skim coat deposited on said layer of polyethylene, said heat-transfer label being deposited on said wax skim coat.

47. The method as claimed in claim 45 wherein said carrier comprises wherein said carrier comprises a polymeric film overcoated with a release coating made of a non-wax, non-silicone, thermoset release material, said release coating having a total surface energy of about 25 to 35 mN/m, of which about 0.1 to 4 mN/m is polar surface energy, and having a carbon content (by

atomic %) of about 97% and an oxygen content (by atomic %) of about 3%, as measured by X-ray photoelectron spectroscopy.

48. The method as claimed in claim 47 wherein said polymeric film is made of a polymer selected from the group consisting of polyesters, polyolefins and polyamides and wherein said release coating is made by (i) applying to the polymeric film in its amorphous or semi-oriented state a composition comprising (a) a functionalized α -olefin containing copolymer and (b) a crosslinking agent; and (ii) reacting said composition with the carrier during uniaxial or biaxial stretching and heat setting.

49. The method as claimed in claim 44 wherein each of said ink design layers comprises a binder, a colorant and a cross-linking system, said cross-linking system being adapted to effect cross-linking of the binder within about 1-2 minutes after said ink design layer has been transferred to a glass article heated to a temperature of about 250°F-325°F.

50. The method as claimed in claim 49 wherein said binder comprises one or more resins selected from the group consisting of polyester resins, polyester/vinyl resins, polyamide resins, phenoxy resins, epoxy resins, polyketone resins, and acrylic resins.

51. The method as claimed in claim 50 wherein said binder additionally comprises a vinyl chloride/vinyl acetate resin.

52. The method as claimed in claim 50 wherein said binder comprises a copolyester resin having a high tensile strength and low elongation.

53. The method as claimed in claim 49 wherein said colorant is a pigment, said pigment being present in an amount ranging from about 50% to 200%, by weight, of the total of said binder and said cross-linking system.

54. The method as claimed in claim 49 wherein said cross-linking system comprises (i) a cross-linking resin for cross-linking said binder and (ii) a heat-activatable catalyst for catalyzing the cross-linking of said cross-linking resin to the binder within about 1-2 minutes after transfer of said heat-transfer label to an article heated to a temperature in the range of about 250°F-325°F.

55. The method as claimed in claim 54 wherein said cross-linking resin comprises a melamine-formaldehyde resin and wherein said heat-activatable catalyst is an amine-blocked sulfonic acid catalyst.

56. A heat-transfer label assembly, said heat-transfer label assembly comprising:

(a) a carrier; and

(b) a heat-transfer label, said heat-transfer label being releasably secured to said carrier for transfer of said heat-transfer label from said carrier to an article under conditions of heat and pressure, said heat-transfer label comprising one or more ink design layers, each of said ink design layers being thermosetting within about 1-2 minutes after said ink design layer has been transferred to an article heated to a temperature of about 250°F-325°F.

57. The heat-transfer label assembly as claimed in claim 56 wherein said heat-transfer label consists of said one or more ink design layers.